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Original article

Prevalence of night eating syndrome associated with psychological disorders among university students: A metaanalysis

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ABSTRACT

The objective of this meta-analysis was to find out the prevalence of Night Eating Syndrome (NES) associated with psychological disorders among university students. Extensive search of database yielded 1541 articles matching the search keywords, out of which were 1528 were excluded due to difference in population, outcome, and study design. At the end, only 13 articles were retrieved which aligned with the inclusion criteria. Prevalence of NES associated with psychological disorders in 9432 participants was 8.2% (95% CI 4.9: 13.4) but there was high level of heterogeneity. Female university students had a higher prevalence of the disorder (7.2%) with a high degree of heterogeneity (τ^2 = 0.687, I^2 = 96%, P < 0.01), as compared to male students (4.9%) with lower heterogeneity. Nevertheless, high level of clinical heterogeneity was observed in this metanalysis which mandates more real-world studies with larger samples to validate the causal relationship.

1. Introduction

NES is a rare disorder characterized by overeating at late night as well as sleep disturbances and evening mood alterations and similar other related symptoms. Precisely, patients with NES, are symptomized by prolonged cycle of food intake, in which nocturnal eating and/or heavy food consumption occurs regularly after supper (Allison et al.,2010). NES prevalence is about 1–2 every 100 individuals in the general population whereas in obese it is about 6–16% (Cleator et al., 2012).

Literature review suggests that NES and psychological disorders are correlated; especially mood depression and major depressive disorder have been found to have significant association in the previous literatures (Colles et al, 2007; Ko and Jeong, 2012; Meule, 2013). More than 50% of the NES patients were found to be comorbid with major depressive disorder through their lifetime, whereas diagnosis for current major depressive disorder is about 19 out of every 100 individuals (de Zwaan et al., 2014). Progression of NES is propelled by impulsivity, and it has also been found to be associated with other eating disorders like binge eating disorder (BED), bulimia nervosa (BN) and anorexia nervosa (AN). Impulsivity is multifaceted which explains its association with Attention Deficit Hyperkinetic disorders (ADHD), addictive behaviors and several

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other psychopathologies (Allison et al., 2010; Allison and Tarves, 2011).

Development of NES in university students is dependent on several factors (Cooley et al, 2007; Sevincer et al.,2016; Nolan and Geliebter,2019), not limited to, transition from late adolescence to early adulthood, developmental stress, unhealthy eating habits (Riccobono et al., 2020), peer pressure, gender identity (Wichianson et al., 2009; Shakeel et al., 2018; Guo et al., 2020). The performance stress in academics, combined with emotional vulnerability and the uncertainty of prospective career, increases the propensity for depression, anxiety, and stress (Borges et al., 2017; Kandeger et al., 2018).

Additionally, research suggests that higher levels of depression results in exaggerated emotional eating as a potential strategy for overcoming depression (Prince, 2014). College students share some of these characteristics significantly as compared to other age groups (Riccobono et al., 2020; Borges et al., 2017; Kandeger et al., 2018). Till date no meta-analysis of NES linked to psychological symptoms has been reported, which serves as an important criterion for conducting this study. Hence, this research was designed to determine the prevalence of NES associated with psychological symptoms among college students.

2. Methodology

2.1. Sources of data and population selection

The search for data was carried out in two steps using electronic media. In the first step, three authors (Faizan Kashoo, Md. Miraj and Shakir Saleem) searched for NES related data in January, February, and March 2021 respectively. The databases that were examined for literature were, Cochrane CENTRAL (Cochrane Library), Science Citation Index (Web of Science), Cumulative Index to Nursing and Allied Health Literature (Elsevier), Medline (Ovid) and Embase (Elsevier). Citations were sorted using Microsoft Excel and Mendeley. A comprehensive systematic literature search was conducted due to the scarce data available on NES associated with psychological disorder among college students. The search was carried out by employing Boolean operator "AND" and "OR", in the advance search settings of keywords, abstract or title. A combination of different key terms like "NES", or "evening eating" or "nocturnal eating" or "NE behavior" or "late night eating" or "night eating*" were included in the search criteria.

The retrieval process of references was verified by two secondary authors against the inclusion criteria, by classifying them as either 'Included' or 'Excluded.' Access to full article was the criteria for classifying them as being 'included'. All three authors reached a 97% agreement following their verification checks of all the referenced studies. The detailed study selection process with the criteria for exclusion using the PRISMA flow diagram is shown in Fig. 1 (Moher et al, 2009). The transparency and appropriateness of reporting was confirmed using PRISMA checklist. In the first search, 1541 articles were found meeting the search keywords and were retrieved for consideration. In the beginning of the exclusion process, 1494 articles did not match the inclusion requirements as they were not related to the hypotheses, which was confirmed by reviewing and examining the papers' titles and abstracts. At the end, only 13 articles remained for the final sample and 34 full text exclusion was made due to difference of population sample, study type and outcome differences. No metanalysis was found to be reported among the studies in our entire screening process.

2.2. Quality assessment

The quality of the studies was assessed by two independent authors using the Newcastle-Ottawa scale, adapted for cross-sectional research (Modesti et al., 2016; Azharuddin et al., 2021). The scale consists of three index columns namely, selection (★★★★★), comparability (★★) and outcome (★★★) for which a maximum grading of 10 points is allowed. The risk of biases was reduced using internal systematic error and external validity of the studies. Based on the previous reports, all the 13 studies were classified under four levels: very good (9–10 points), good (7–8 points), satisfactory (5–6 points) and unsatisfactory (0–4 points) and the used scale was composed of seven items (Azharuddin et al., 2021). Any disagreement was resolved through consensus of third reviewer (Table 1).

2.3. Principal summary measures and statistical analysis

The data was broken down into two categories: overall prevalence and gender. Pooled prevalence per 100 people and the 95% confidence intervals was used to calculated using random-effects model. To measure the extent of heterogeneity between studies, the Cochrane Q statistic was calculated and I^2 was employed; with the significant value of $P < 0.05$. The metanalyses was conducted using R software version 3.5.0. The pooled estimates and forest plots were created using the meta program.

3. Results

PRISMA flow chart can be referred for the exclusion of different studies retrieved for this metanalysis (Fig. 1). A total of 13 studies were included to compare different psychological symptoms associated with NES in college students. The occurrence of NES (NEQ > 30 and/or NEQ > 25) was the primary outcome for all the studies. The analysis revealed that none of the included articles were uniform as they had different psychological variables, therefore, very high heterogeneity was observed for them ($\tau^2 = 0.978$, $I^2 = 97.0\%$, $P < 0.01$). Moreover, the association of NES was classified by categorizing different psychological symptoms like coping behavior, nightmares, anxiety, impulsiveness, depression, stress, and insomnia etc.

3.1. Quality assessment

Corresponding to the New Castle Ottawa scale, 7 studies scored between 5 and 6; and remaining 6 studies scored between 7 and 8 out of 10, suggesting satisfactory and good quality of studies respectively (Table 1).

3.2. Primary outcomes

It was observed that prevalence of NES associated with psychological disorders were 9 in females whereas 8 in males. The outcome of this meta-analysis revealed that prevalence of NES among university students was 8.2% (95% CI 4.9: 13.4). Significant evidence of between-study heterogeneity was noticed ($\tau^2 = 0.978$, $I^2 = 97.0\%$, $P < 0.01$) (Fig. 2).

Figs. 3 and 4 represents prevalence of NES in males and females respectively, where it was observed that males had a prevalence of 4.9% (95% CI 3.5; 6.9) with lower heterogeneity ($\tau^2 = 0.214$, $I^2 = 83\%$, $P < 0.01$) whereas females had a prevalence of 7.2% (95% CI 4.2; 12.0) with higher heterogeneity ($\tau^2 = 0.687$, $I^2 = 96\%$, $P < 0.01$).

4. Discussion

The extensive review of previously reported studies revealed that NES is associated with psychological disorders (such as sleep disturbances, depression, and anxiety etc.) among university

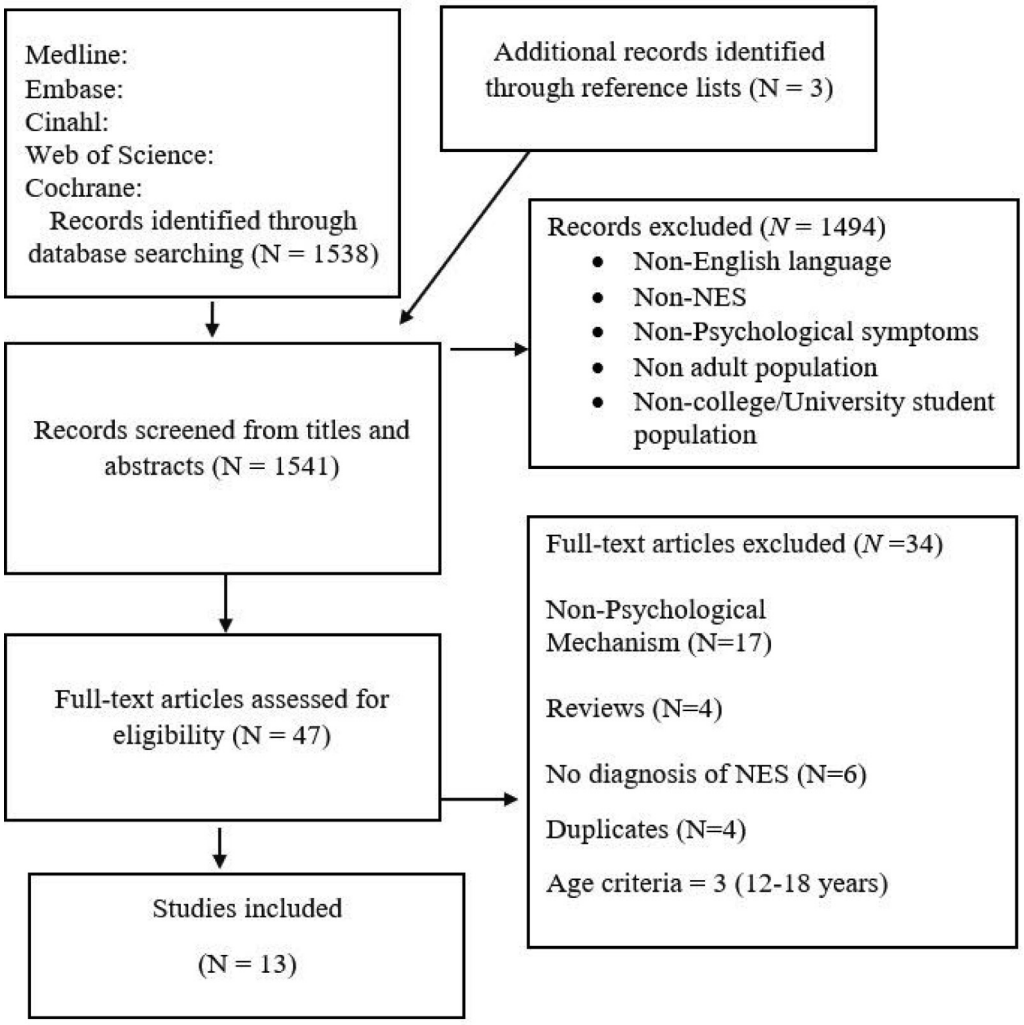

Fig. 1. PRISMA flow diagram.

students (Sevinger et al., 2016; Borges et al., 2017; Nolan and Geliebter; 2019; Guo et al., 2020). Allison et al., 2010 and other similar studies, stated in their study that eating is a precursor to sleep and hence, one must eat in order to initiate or return to sleep, and this has been considered as an NES descriptor (Allison et al, 2010; Vinai et al., 2015).

The majority of NES tests among college students show that it is more common than in the overall population. This study also shows that health promotion efforts should take into account the probability of an increased prevalence of NES among students, as well as the importance of proper dietary habits for this demographic. The severity of depression, anxiety, and stress symptoms as measured by the Depression Anxiety Stress Scales (DASS-21) questionnaire was found to be strongly associated to NEQ scores. This conclusion backs up findings from earlier studies that looked at psychological changes using different tools. Several studies, including one with university students, have validated the association between NES and depressive symptoms as measured by the Beck Depression Inventory (BDI).

Irrespective of the greater evidence that patients with NES have higher levels of depression, not all research showed statistical significance for this association. Whether depressed symptoms are a cause, or an outcome of the illness is not yet established. Borges et al. (2017) stated that students and female participants who worked more than 4 h per day early in the morning had greater levels of depression among the young population. However, an increase in symptoms of depression did not lead to a significant increase in the matching NEQ scores in these two studies.

Various scales, including as the DASS-21, BDI, and NEQ, were utilized to evaluate the prevalence of NES in the included research studies (Latzer et al., 2014; Yahia et al., 2017; Aloi et al., 2018). NEQ is an established standard tool for identifying NES, depending on the severity of the condition the score scale and cut-off point ranges from > 25 to > 30, therefore the same range was used in this metanalysis. In this meta-analysis of 13 cross-sectional studies, overall prevalence of 8.2% with a 95% CI (4.9; 13.4) was found in a total of 9432 university students. Prevalence of NES associated with psychological disorders among female students was 7.2% (95% CI (4.2; 12.0)) with higher heterogeneity (τ^2 = 0.687, I^2 = 96%, P < 0.01) as compared to male students (4.9% at 95% CI (3.5; 6.9)) (τ^2 = 214, I^2 = 83%, P < 0.01).

The presented metanalysis determined the magnitude of the NES associated with psychological disorders by revealing its high incidence among the adolescents across the globe. In order to develop better measures based on scientific facts, special attention should be devoted to the most vulnerable adolescent group.

5. Study limitations

Some of the studies included in this evaluation provided association data but did not offer prevalence or confidence intervals, nor

Table 1
Quality assessment of included studies using Newcastle-Ottawa Scale.

S. no.	Author year	Title	Study design	Selection (Maximum 5 stars)	Comparability (Maximum 2 stars)	Outcome (Maximum 3 stars)	Total score (Maximum 10 stars)	Quality of the study
1.	Aloi et al. (2018)	Validation of the Italian version of the Night Eating Questionnaire (I-NEQ)		★★★★★	★	★★	8	Good
2.	Borges et al. (2017)	Night eating syndrome and emotional states in university students	Cross-sectional study	★★★★	★	★	6	Satisfactory
3.	Gan et al. (2019)	Determination of Risk factors for Night Eating syndrome	Cross-sectional study	★★★★	★	★★	7	Good
4.	Guo et al. (2020)	Night-Eating Syndrome and Depressive Symptoms in College Freshmen: Fitness Improvement Tactics in Youths (FITYou) Project	Cross-sectional study	★★★★	★	★★	7	Good
5.	He et al. (2019)	The relationship between neuroticism and night eating: exploring the mediating roles of psychological distress and maladaptive coping		★★★★★	★	★★	8	Good
6.	He et al. (2017)	Prevalence, demographic correlates, and association with psychological distress of night eating syndrome among Chinese college students		★★★	★	★★	6	Satisfactory
7.	Kandeger et al. (2018)	The relationship between night eating symptoms and disordered eating attitudes via insomnia and chronotype differences	Cross-sectional study	★★★★	★★	★★	8	Good
8.	Lee and Suh (2018)	The Mediating Effect of Anxiety in the Relationship between Nightmares and Night Eating Syndrome in Female Undergraduate Students	Cross-sectional study	★★★	★	★	5	Satisfactory
9.	Nolan and Geliebter (2019)	Factor structure of the Night EatingDiagnostic Questionnaire (NEDQ) and an evaluation of the diagnostic criteria of the night eating syndrome	Cross-sectional study	★★★	★	★★	6	Satisfactory
10.	Sevincer et al. (2016)	Night Eating Syndrome Frequency in University Students: Association with Impulsivity, Depression, and Anxiety		★★★	★	★	5	Satisfactory
11.	Ahmed et al. (2019)	Prevalence of night eating syndrome amongst Medical Students in Saudi Arabia	Cross-sectional study	★★★	★	★★	6	Satisfactory
12.	Ibrahim et al. (2019)	Night Eating Syndrome and Food Addiction in Turkish Population		★★★	★	★★	6	Satisfactory
13.	Yahia et al. (2017)	Night eating syndrome and its association with weight status, physical activity, eating habits, smoking status, and sleep patterns among college students		★★★★	★	★★	7	Good

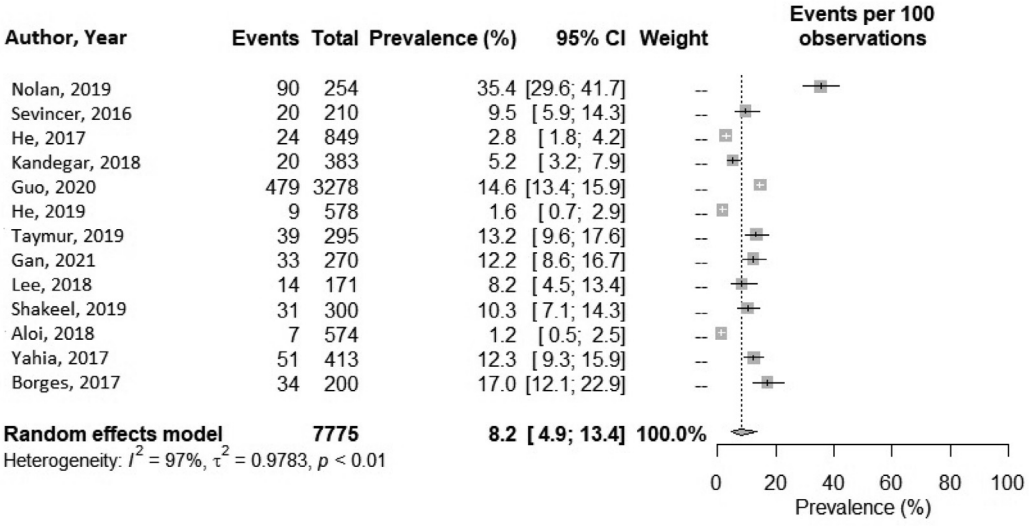

Fig. 2. Illustrates prevalence of NES among university students. The vertical-dashed lines show the pooled summary estimate whereas the horizontal lines show the event estimates at 95% CI. The area of each square is proportional to the estimate's inverse variance.

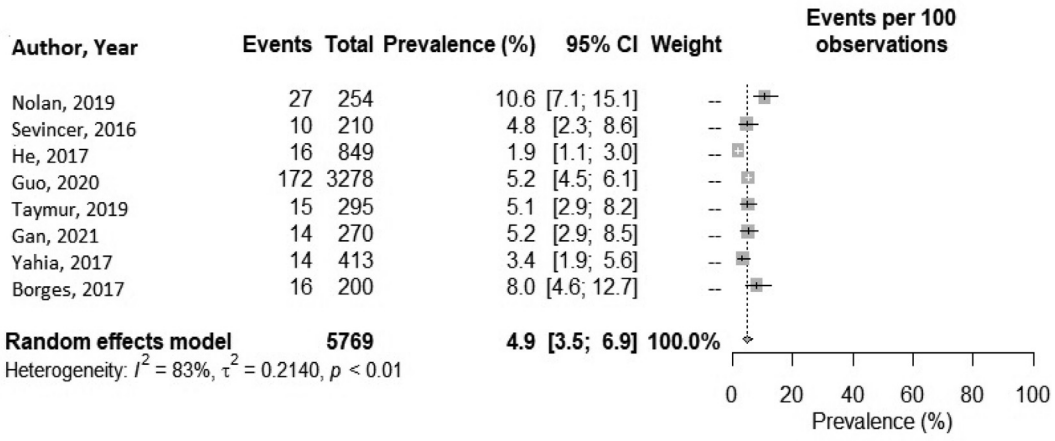

Fig. 3. Illustrates prevalence of NES among male students. The vertical-dashed lines show the pooled summary estimate whereas the horizontal lines show the event estimates at 95% CI. The area of each square is proportional to the estimate's inverse variance.

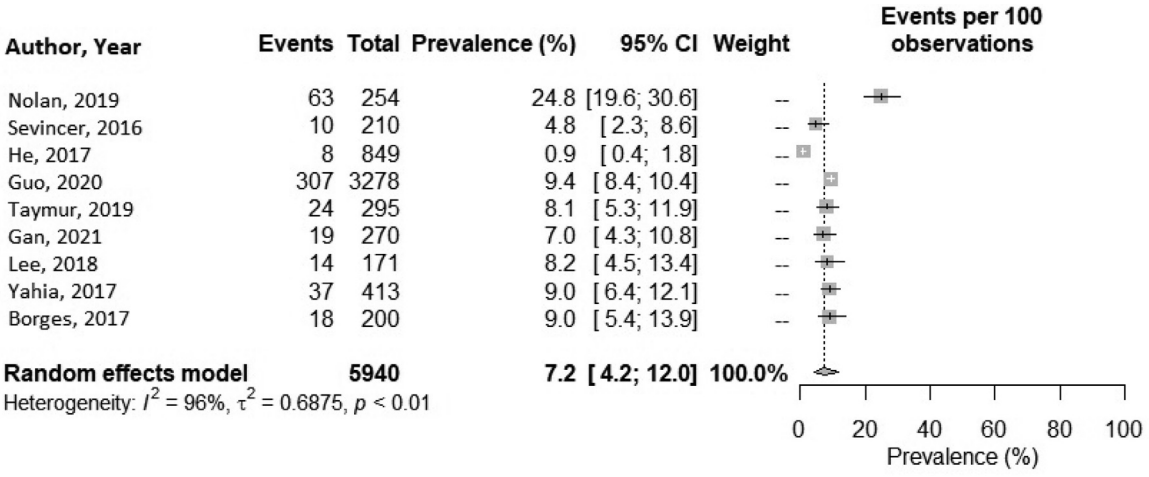

Fig. 4. Illustrates prevalence of NES among female students. The vertical-dashed lines show the pooled summary estimate whereas the horizontal lines show the event estimates at 95% CI. The area of each square is proportional to the estimate's inverse variance.

did they provide a description of the population studied. Because the articles did not provide enough information, the authors could not be identified, or communication attempts remained unanswered, it's probable that this review did not contain all relevant publications.

Different cut-off criteria for the NEQ and other questionnaires indicated in the original studies were found to be a complication in identifying cases of NES and comparing studies. Despite efforts to consolidate studies that were as similar as feasible, this evaluation included investigations conducted at diverse times and locations, as well as studies using different approaches. Due to these typical variabilities in the selected cross-sectional studies, we performed but could not achieve a significant outcome for the subgroup analysis and meta-regression.

5.1. Strengths of the study

The presented metanalyses was registered in PROSPERO and followed a blind study selection pattern. Moreover, updated analytical methods were used, and a scientific search methodology that allowed the collection of a significant number of studies was followed in the formulation of this systematic review. A thorough search of the literature sources, reference lists of qualifying papers and grey literature was done for this analysis. Moreover, the PRISMA tool guide was used for excluding the inappropriate research articles. In conclusion, this study is the first meta-analysis of its kind, as the authors were unable to locate any previous meta-analyses of NES-related psychological disorders among university students.

6. Conclusion

According to the interpretations of this metanalysis, female students were found to be more susceptible to NES associated with psychological disorder than male students. Nevertheless, high level of clinical heterogeneity was observed in this metanalysis which mandates more real-world studies with larger samples to validate the causal relationship.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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